Modeling and Structural Analysis of Rear Axle Casing of Tractor

E. Mahavishnu¹, R. Manikandan², M. Ramakrishna³
¹,²,³ Assistant Professor, Department of Aeronautical Engineering, Bharath Institute of Higher Education and Research, Chennai.

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ABSTRACT: In this research paper we are going to analysis the rear axle hosing of the tractor for circular, rectangular and elliptical shape to improving the structural stability and load carrying capacity, deformation and fatigue analyze done in FEA methodology, model designed in CATIA software.

Keywords: Rear axle hosing, FEA, Rectangular and elliptical hosing, CATIA

INTRODUCTION

In tractor rear axle having more amount dynamic load because continuous rotation, here the applying load and cycle of rotation also high, therefore the axle component life will be reduce or it will be damaged before reaching maximum load factor. The rear axle material should withstand this fatigue load that’s why choosing SG 500 casting iron; it has more wear resistance, high toughness, fatigue resistance and also having excellent ductility characteristic.

Here we going to modify the rear Axle shape from circular to rectangular and elliptical shape but the material are same. With help of Finite element method technique we can able to ductile and fatigue analysis this modified shape for required boundary condition,

The model is designed in CATIA software, meshing and analysis done in FEA software, finally we compare the deformation fatigue results for three shape.

MODELING

Modeling of rear axle housing done in CATIA Software for TAFE 1002 4WD tractor the model have the circular shape of the housing structures, these structures can be modified as the rectangular shape and elliptical shapes.

MODELING OF REAR AXLE CASING FOR TRACTOR

Structural Boundary Conditions for rear axle housings
Support: fixed support
Load: 1000N
Length: 1m
No of division: 1000
FEA model

Circular shape

Elliptical shape

Rectangular model

Meshing:
Meshing done in FEA software here we used tetrahedral elements for more accuracy.
Structural Analysis and Results:

Deformation results:
### Total Deformation results of rear axle housings

**Shape** | **Total deformation**
---|---
Circular shape | 0.07701
Ellipse shape | 0.079218
Rectangular shape | 0.056793

**EQUIVALENT STRESS**

- **Circular shape**
- **Elliptical Shape**
- **Rectangular shape**
Equivalent stress results

<table>
<thead>
<tr>
<th>Shape</th>
<th>Equivalent stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular shape</td>
<td>15.036</td>
</tr>
<tr>
<td>Ellipse shape</td>
<td>14.384</td>
</tr>
<tr>
<td>Rectangular shape</td>
<td>12.26</td>
</tr>
</tbody>
</table>

MAXIMUM PRINCIPLE STRESS

Circular shape

Ellipse shape
Maximum principle stress

<table>
<thead>
<tr>
<th>Shape</th>
<th>Maximum principle stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular shape</td>
<td>11.51</td>
</tr>
<tr>
<td>Ellipse shape</td>
<td>12.336</td>
</tr>
<tr>
<td>Rectangular shape</td>
<td>10.323</td>
</tr>
</tbody>
</table>

MODAL ANALYSIS

Frequency 1

Rectangular shape
Frequency 4

Ellipse shape

Rectangular shape

Frequency 5

Circular shape

Ellipse shape

Rectangular shape
Frequency 6

**Mode Frequency Results for Rear axle housings**
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Round shape</th>
<th>Ellipse shape</th>
<th>Square shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>268.38</td>
<td>285.8</td>
<td>224.59</td>
</tr>
<tr>
<td>2</td>
<td>281.41</td>
<td>298.76</td>
<td>240.12</td>
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<tr>
<td>3</td>
<td>488.72</td>
<td>488.84</td>
<td>336.04</td>
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<tr>
<td>4</td>
<td>566.02</td>
<td>663.62</td>
<td>483.2</td>
</tr>
<tr>
<td>5</td>
<td>663.89</td>
<td>759.11</td>
<td>601.39</td>
</tr>
<tr>
<td>6</td>
<td>1159</td>
<td>1266.6</td>
<td>991.25</td>
</tr>
</tbody>
</table>

**Conclusion**

From the results of rear axle housing structural and modal analysis of tractor axle with the various housing shapes like circular, ellipse shape and square shape of the housings, deformation of the housings rectangular shape got very less stress and principle stress also got very less in the applied load, the low stress results give more structural stability and model analysis rectangular shaped housings got very less mode frequency in dynamic performances also rectangular shape housings, so rectangular housings suitable for heavy duty applications.

**REFERENCES**

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